PRO-LOG® CORPORATION

STD 7000

78C05
80C85A Processor Card

USER'S MANUAL

3/83

FOREWORD

This manual explains how to use Pro-Log's 78C05 Processor Card. It is structured to answer basic questions that you, the user, might ask yourself about the 78C05. We welcome your suggestions for improving our instructions.

The 78C05 is part of Pro-Log's Series 7000 STD BUS hardware. Our products are modular, and they are designed and built with second sourced parts that are industry standards. They provide the industrial manager with the means of utilizing his own people to control the design, production, and maintenance of the company's products that use STD BUS hardware.

Pro-Log supports its products with thorough and complete documentation. Also, to provide maximum assistance to the user, we teach courses on how to design with, and to use, microprocessors and the STD BUS products.

You may find the following Pro-Log documents useful in your work: **Microprocessor User's Guide** and **Series 7000 STD BUS Technical Manual.** If you would like to receive a copy of these documents, please submit your request on your company letterhead.

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SECTION 1
Purpose and Main Features

PURPOSE

The 78C05 processor card combines a buffered and fully-expandable 80C85A microprocessor with a 2K byte-wide CMOS RAM and sockets for an additional 2K bytes of RAM and 8K bytes of CMOS EPROM or ROM (27C16 type).

A connector is provided to allow access to the 7.5, 6.5, and 5.5 interrupt pins as well as the serial input data (SID) and serial output data (SOD) pins on the processor.

Fully implemented in high-speed CMOS, the 78C05 offers high noise immunity, low power consumption, and a wide temperature range. It is designed to be used with other CMOS cards on the STD BUS.

The 78C05 responds to the STD BUS signal BUSRQ* allowing direct memory access (DMA) to other cards used in the system.

FEATURES

- Fully CMOS: High noise immunity, low power consumption, wide temperature range
- 80C85A processor
- 4096 bytes RAM capacity onboard
- 2048 bytes RAM included (static CMOS byte-wide type)
- 8192 bytes EPROM capacity onboard (27C16 type)
- 4 MHz crystal (500 ns clock)
- Three-state address, data and control buses
- Power supply-independent reset circuit
- Five interrupts
- 80C85A SID and SOD lines accessible
- Single +5V operation

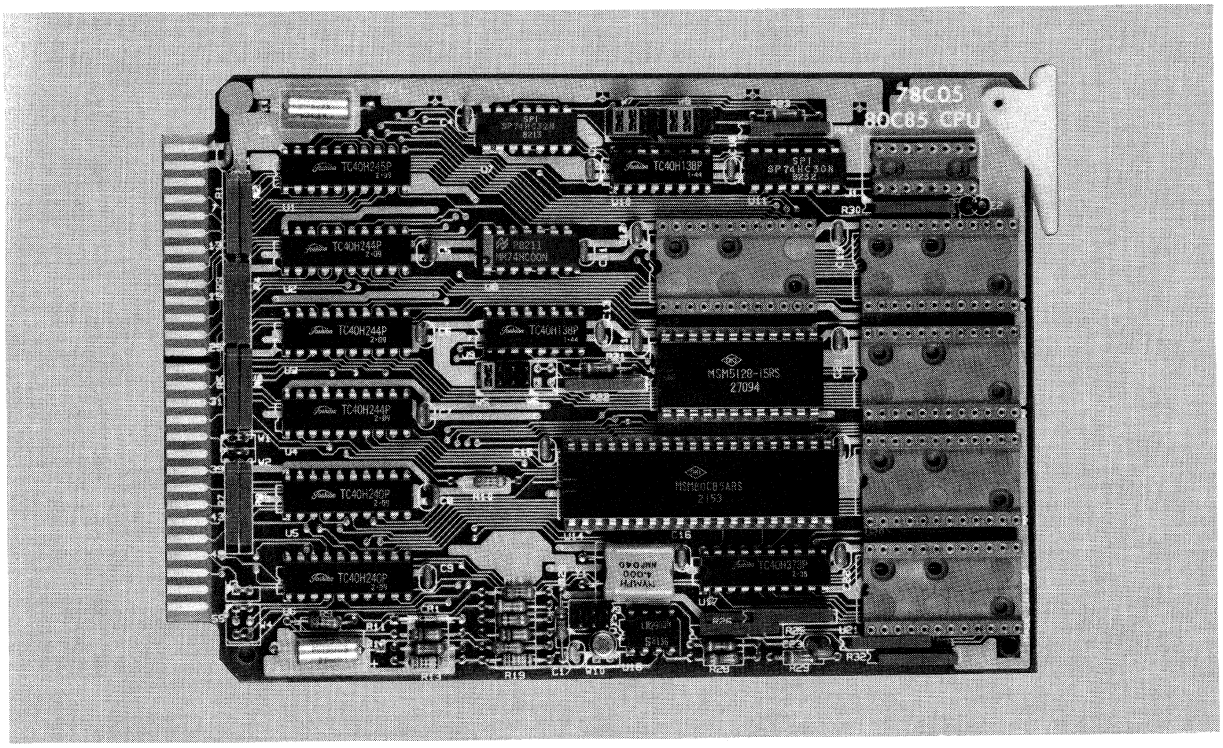


Figure 1-1. 78C05 Processor Card

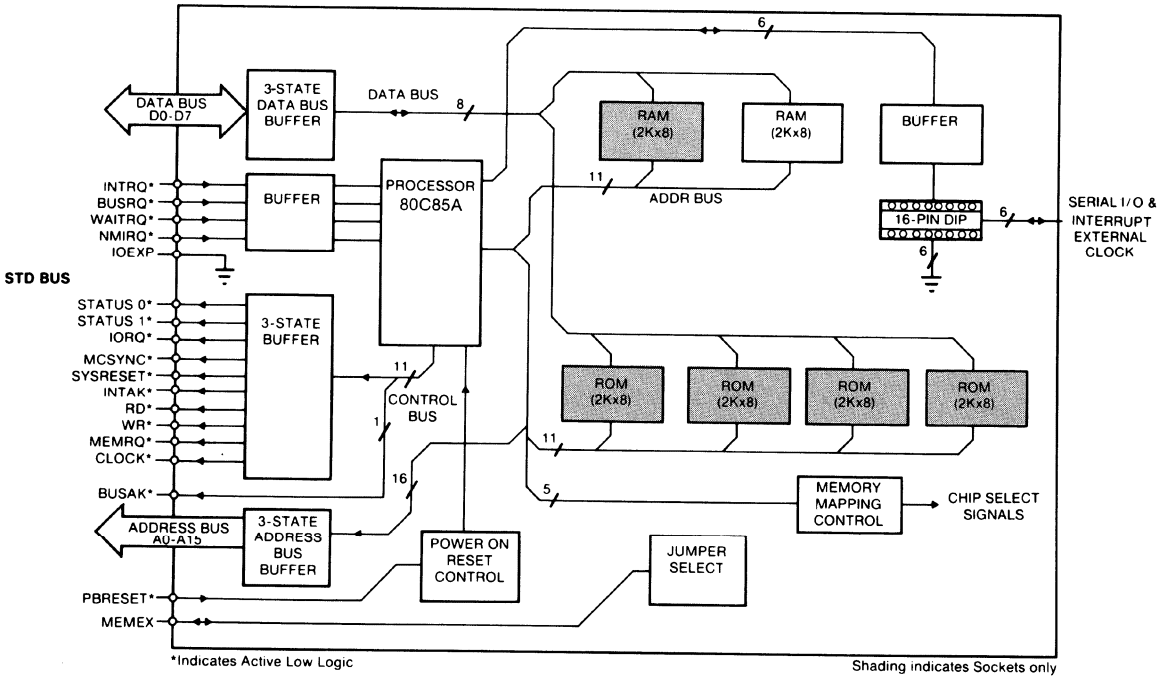


Figure 1-2. Block Diagram (78C05)

9621-B-7805-01

SECTION 2
Installation and Specifications

INTRODUCTION

The 78C05 processor card operates as an integral part of an STD BUS system. It may be inserted directly into the STD BUS backplane, (see figure 2-1) or extended from the motherboard with a 7901 Utility Card Extender.

The 78C05 can be inserted directly into any available slot in the STD BUS card rack. If the 7901 card is utilized, insert it in any available slot in the card rack and then insert the 78C05 into the connector on the 7901 card. This now makes the 78C05 accessible for testing.

CMOS PRECAUTIONS

1. An input to a CMOS gate should not exceed its power supply range. If a high-level input exceeds the power supply voltage, current will flow into the input through the input protection diode. This may result in latch-up or damage.
2. Because of this restriction, in systems using two power supplies, special attention should be paid to: the relative voltage level of the two supplies when each supply is turned on, and the difference in rise and fall times between the two supplies. One way to avoid possible problems when using two supplies is to connect them to each other, directly or through diodes.
3. To prevent damage to CMOS components by static discharge, the card should always be stored in a conductive carrier. Individuals and tools should be grounded before coming in contact with the card.

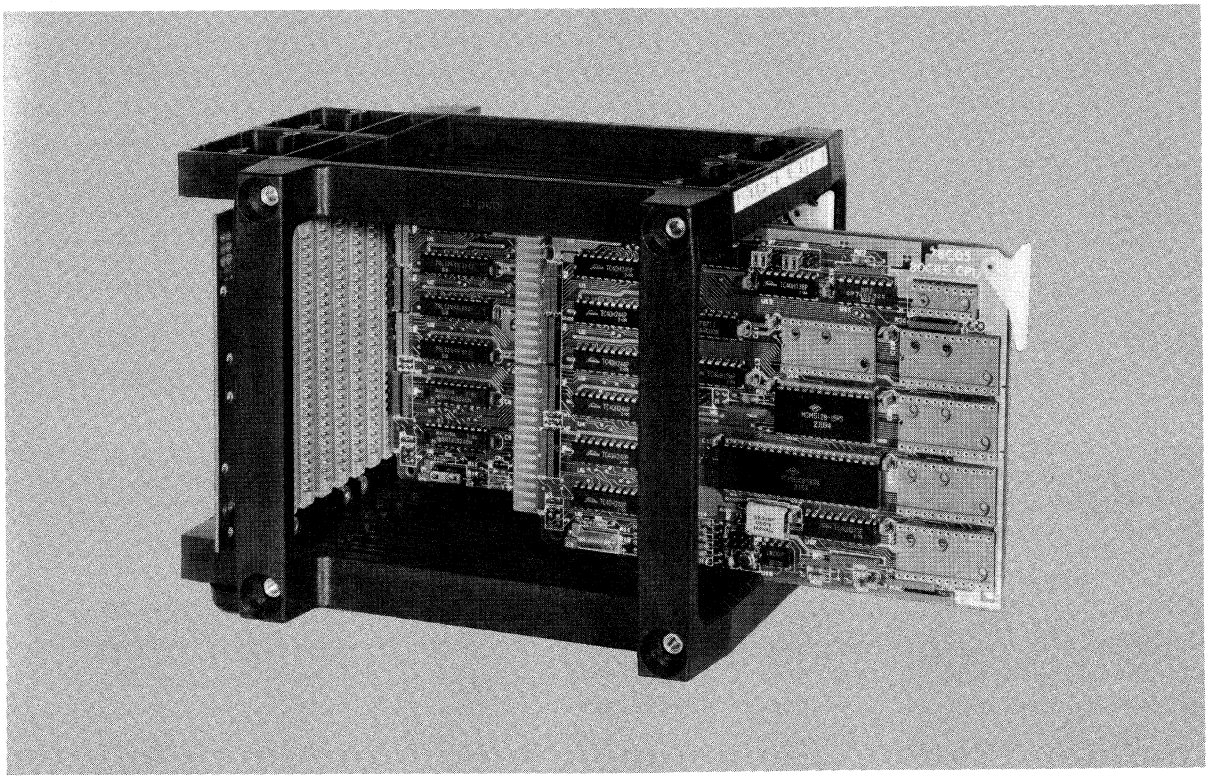


Figure 2-1. Installation in STD BUS Card Rack (78C05)

W1	1-2 no jumper	=STD BUS MEMEX line grounded =STD BUS MEMEX left floating, must be driven
W2	1-2 no jumper	=STD BUS IOEXP line grounded =STD IOEXP line left floating, must be driven
W3	1-2 no jumper	=80C85A clock driven onto STD BUS CLOCK* line =STD BUS CLOCK* pulled up
W4	1-2 & 5-6	=STD BUS INTRQ* line connected to INT input of 80C85A, and external interrupt input J1-3 connected to 80C85A interrupt input RST 5.5
	3-4	=STD BUS INTRQ* line connected to 80C85A interrupt input RST 5.5, and external interrupt input J1-3 not connected
W5		Affects memory mapping (see figure 2-5)

W6	1-2 3-4 no jumper	=Onboard memory enabled with MEMEX high =Onboard memory enabled with MEMEX low =Onboard memory permanently enabled
W7		Each removed jumper disables one EPROM socket (see figure 2-3)
W8		Affects RAM memory mapping (see figure 2-5) Also used to disable RAM sockets (see figure 2-3)
W9	1-2	=Processor's clock input connected to STD BUS CNTRL* line. Crystal must be removed.
	3-4	=Processor's clock input connected to external clock input EXT CLK J1-8. Crystal must be removed.
	no jumper	=Processor's clock input connected to onboard clock
	5-6	Not used
W10		For Pro-Log use only

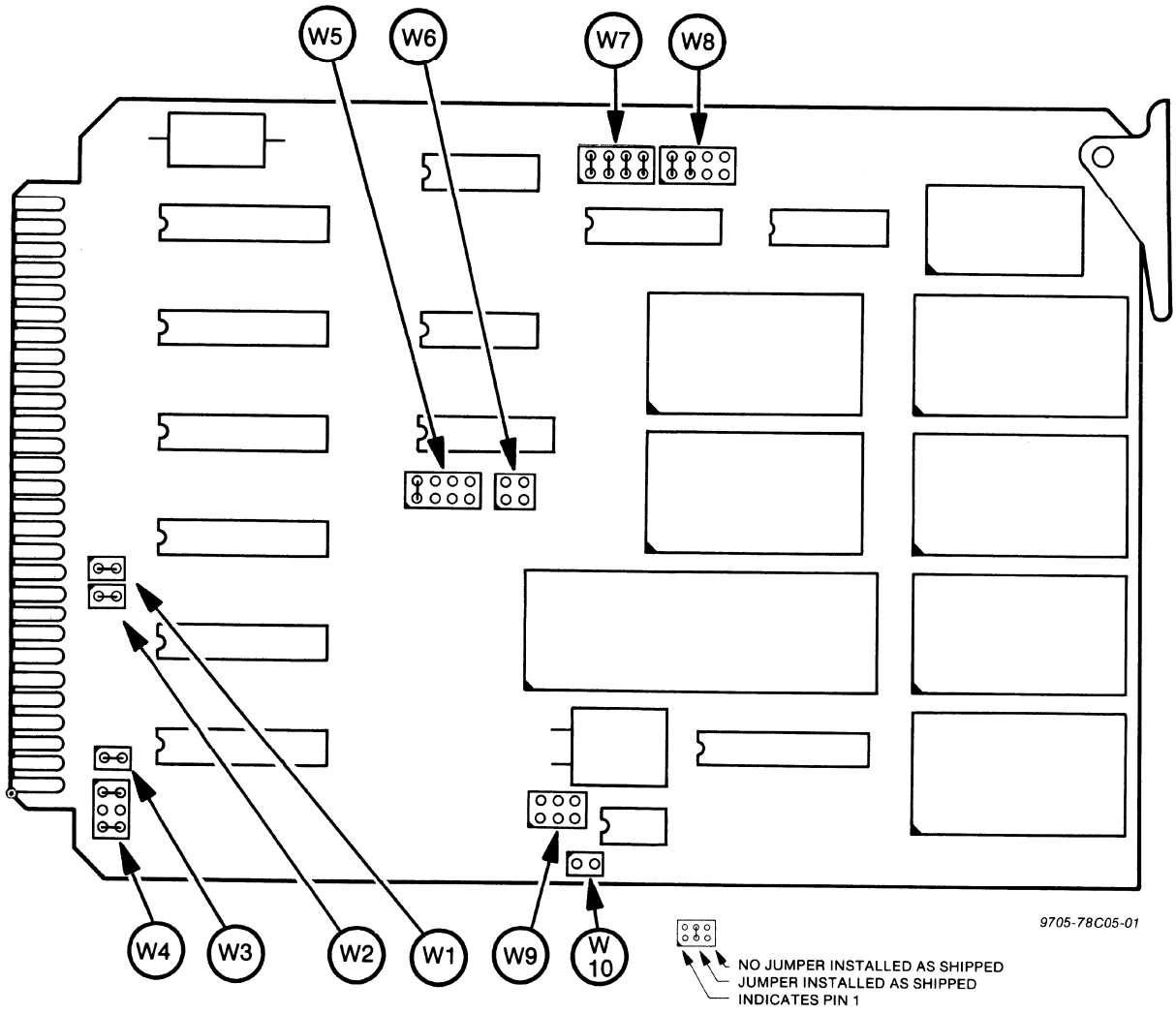


Figure 2-2. Jumper Locations and Functions (78C05)

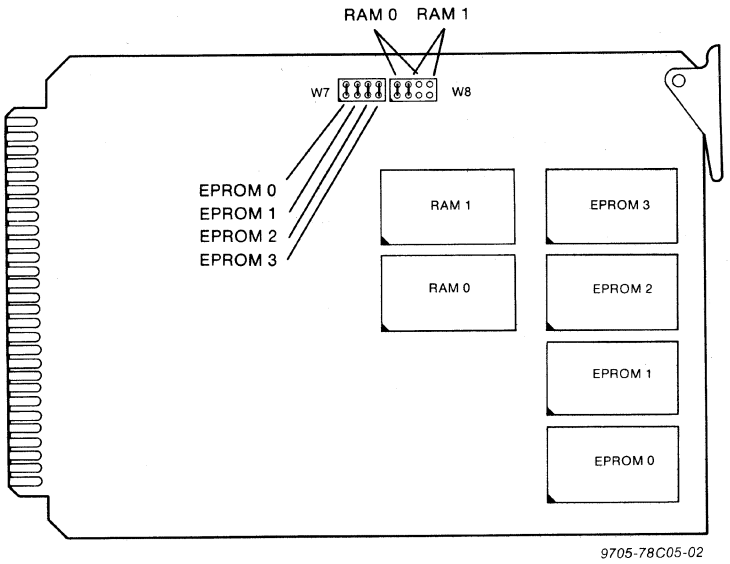


Figure 2-3. Chip Disable Jumpers (78C05)

JUMPER OPTIONS

The 78C05 has several optional functions which are selectable by wire jumpers. Figure 2-2 shows the locations and the functions of these jumpers. After reviewing the jumper options available, check to be certain the card is properly configured to your specific application before installing it in the system.

These jumpers can be disconnected simply by cutting them. Be sure to cut them in two places to prevent them from re-shorting. To replace a jumper, cut in half and remove one half at a time. Remove any excess solder and install new jumpers as needed.

If there is a need to frequently change these jumpers (e.g., in prototyping), you may want to replace these wire jumpers with slip-on connectors. Permanent 0.025 inch square posts can be installed which will accept the slip-on connectors. Figure 2-4 provides a list of part numbers for these jumper replacements.

PART	MANUFACTURER PART NUMBER	
	ELCO CORP.	BERG ELECTRONICS
2-PIN HEADER	00 8261 02 32 00 852	65611-102
4-PIN HEADER	00 8261 04 32 00 852	65611-104
6-PIN HEADER	00 8261 06 32 00 852	65611-106
8-PIN HEADER	00 8261 08 32 00 852	65611-108
CONNECTOR	00 8261 02 42 00 870	—

Figure 2-4. Wire Jumper Replacements (78C05)

MEMORY MAPPING

The 78C05 processor card contains two sockets for 2K x 8 byte-wide CMOS RAM and four sockets for 2K x 8 CMOS EPROMs (27C16 type). One 2K x 8 CMOS byte-wide RAM chip is provided by Pro-Log. Jumper block W7 and W8 are provided to disable any unused memory sockets. Memory addresses normally occupied by the unused sockets can then be designated to devices outside the 78C05.

The 78C05 can be mapped to any one of the four 16K quadrants addressable by an 8-bit microprocessor. The card itself will only occupy 12K of the 16K available. The remaining 4K can be occupied by external memory devices. For example, the card as shipped can be mapped 0000 to 3FFF. This configuration leaves 3000 to 3FFF available for external memory.

The 78C05 has another memory addressing option which allows a user to address onboard RAM to the last 4K of memory space within the 16K quadrant. In such a case, the space that RAM would normally occupy would then become open to external memory. Jumper block W5 controls the quadrant that the 78C05 onboard memory resides in. Figure 2-5 describes the memory addressing options for the 78C05.

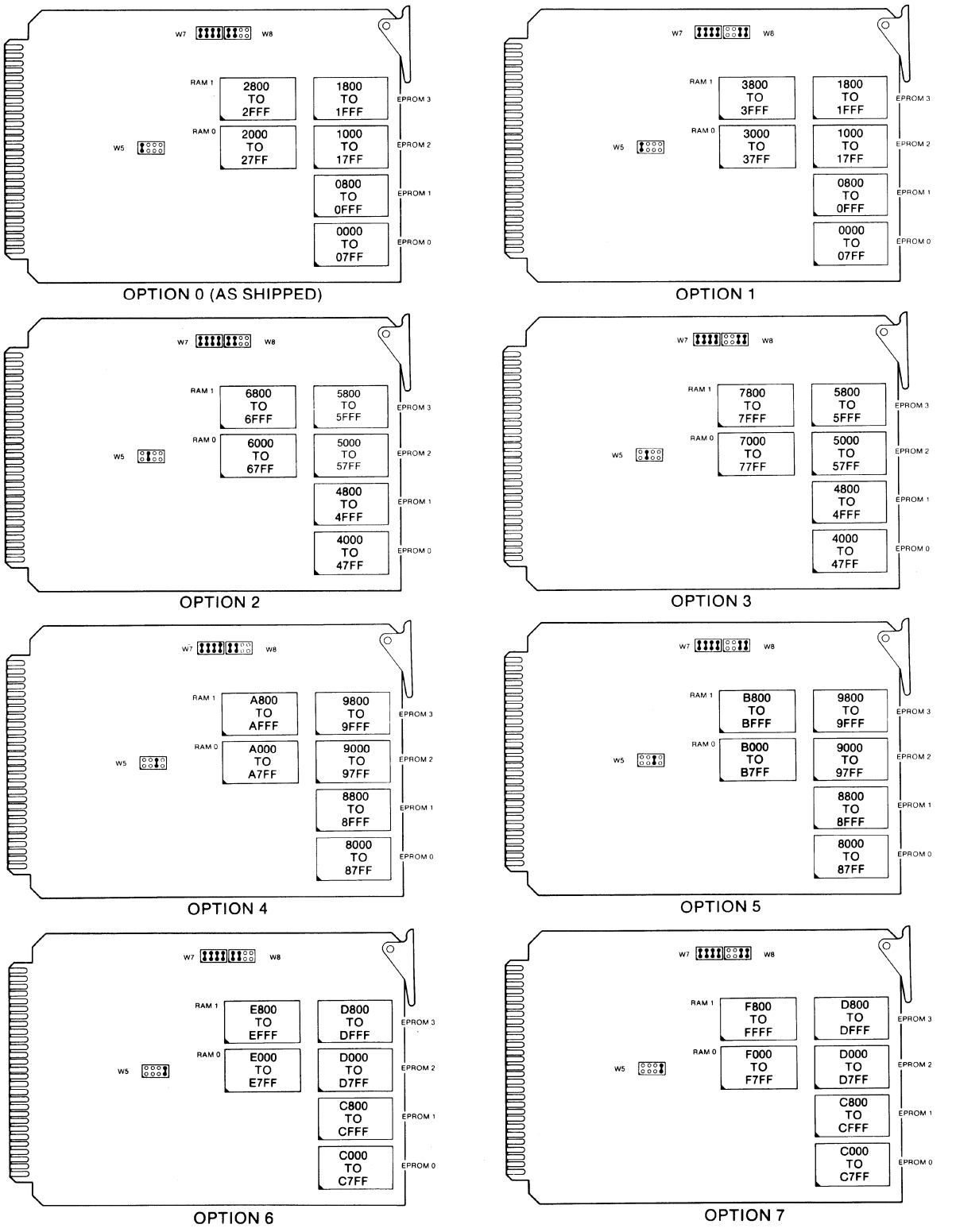


Figure 2-5. Memory Addressing Options (78C05)

MEMORY TYPES

The 78C05 processor card uses two different kinds of memory: 2K RAMs and 2K EPROMs. Figure 2-6 is a list of components which are compatible for use on the 78C05 card. If you wish to use other memory components, compare the manufacturer's data sheets to the socket configurations. Also check their data sheets for any special requirements, and be sure they are designed to be used with CMOS logic.

MANUFACTURER	CHIP	ACCESS
National Semiconductor NM27C16	2Kx8 CMOS EPROM	450-550
OKI MSM 5128	2Kx8 CMOS SRAM	150-250

Figure 2-6. Recommended Memory Devices (78C05)

MEMEX

The MEMEX signal line is part of the STD BUS. It is used as a memory bank select line. It is possible to have two banks of memory, each with up to 64K bytes, in a system. One bank would be enabled when MEMEX his high, and the other when MEMEX is low. Pro-Log memory cards include the MEMEX line in their address decoding.

There are several jumper options affecting MEMEX. Jumper W1 determines whether MEMEX will be grounded or if it will be left floating for another card in the system to control. As shipped it is grounded. Jumper W6 determines how onboard memory will respond to MEMEX. Jumper 1-2 causes onboard memory to respond to MEMEX high and pulls up MEMEX in the event that it is not driven. Jumper 3-4 causes onboard memory to respond to MEMEX low. No jumper (as shipped) leaves onboard memory independent of MEMEX. See figure 2-2 for the physical location of these jumper blocks.

As shipped, jumper block W6 has no jumper installed. The pull-up resistor causes onboard memory to be permanently enabled.

IOEXP

The IOEXP line is one of the STD BUS standard signals. It is used to select between different banks of input and output ports. The 78C05 does not control the IOEXP line. IOEXP is grounded on the 78C05 through jumper W2. If another card needs control of the IOEXP line, jumper W2 can be removed. This will leave the line floating. See figure 2-2 for the physical location of jumper W2.

J1 16-PIN DIP SOCKET

The 78C05's socket J1 allows the user to gain access to several of the pins on the 80C85A processor chip (see figure 2-7). Pins 1 through 3 allow the user to implement the vectored interrupt pins on the processor. Pins 4 and 5 are connected to the processors SID and SOD pins allowing the user to create a serial port directly into the processor. Pins 6 and 7 are spares and pin 8 is an external clock input. Pins 9 through 16 are grounded. Figure 2-8 describes the loading characteristics of the J1 socket.

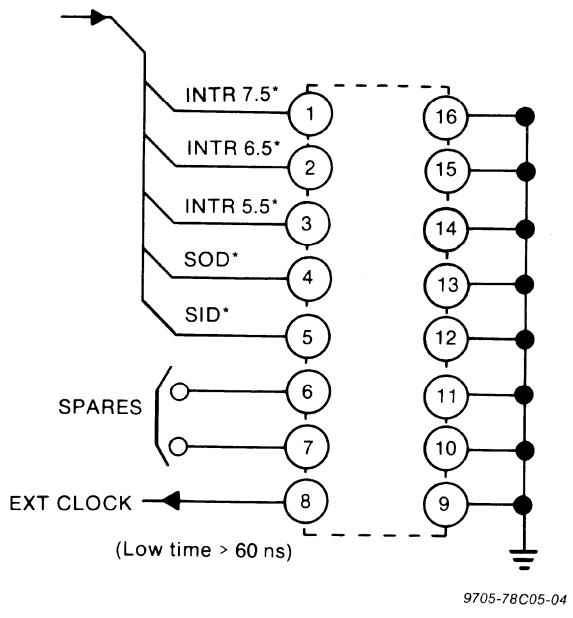


Figure 2-7. The J1 16-Pin Socket (78C05)

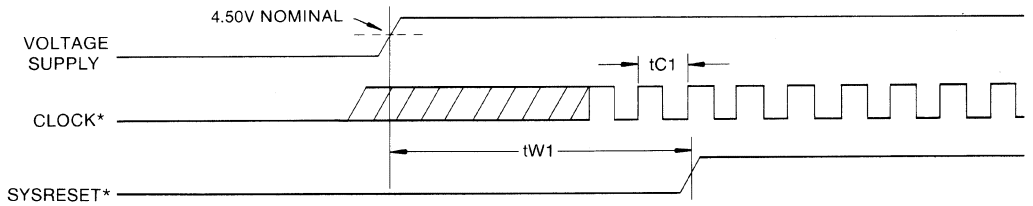
PIN NUMBER				PIN NUMBER			
OUTPUT (CMOS DRIVE)[1]				OUTPUT (CMOS DRIVE)[1]			
INPUT (CMOS LOADS)[1]						INPUT (CMOS LOADS)[1]	
MNEMONIC							MNEMONIC
Interrupt 7.5*	1		1	16	OUT		Ground
Interrupt 6.5*	1		2	15	OUT		Ground
Interrupt 5.5*	1		3	14	OUT		Ground
SOD*		10	4	13	OUT		Ground
SID*	1		5	12	OUT		Ground
(Spare)			6	11	OUT		Ground
(Spare)			7	10	OUT		Ground
External Clock	1		8	9	OUT		Ground

[1] CMOS load = 10 pF at ±5 μA
* Designates active low-level logic

Figure 2-8. Load Characteristics and Pinouts for the J1 Connector (78C05)

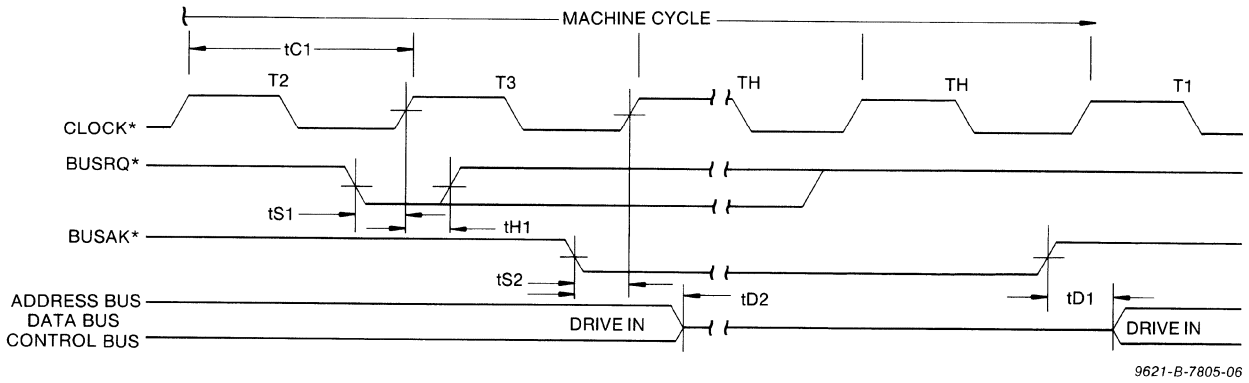
TIMING SPECIFICATIONS

Figures 2-9 through 2-13 show the signal sequences and timing for various 78C05 functions. They show the signals as they appear at the card edge connector of the 78C05.



SYMBOL	PARAMETER	UNIT	4.00 MHz	
			MIN	MAX
tC1	Clock cycle time	ns		500
tW1	Power-up reset width after supply threshhold	ms	25	85

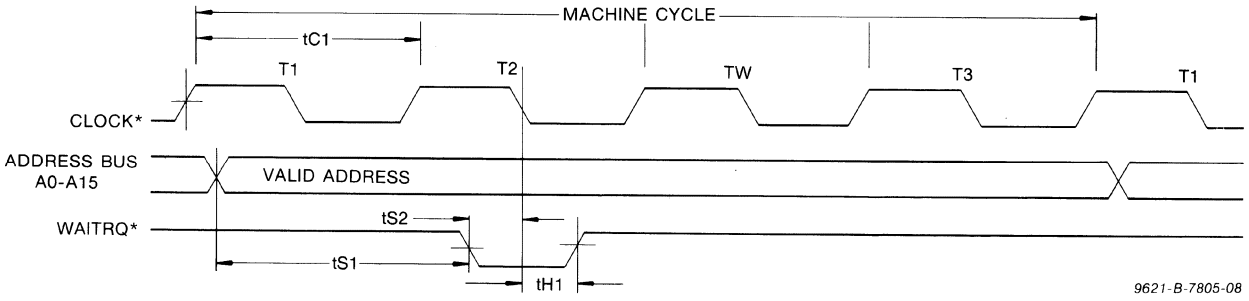
Figure 2-9. Reset After Power-up (78C05)



SYMBOL	PARAMETER	4.00 MHz	
		MIN	MAX
tC1	Clock cycle time		500
tD1	Bus delay after BUSAK* high		400
tD2	Bus delay after BUSAK* low		55
tH1	BUSRQ* hold after start of T3	0	
tS1	BUSRQ* setup prior to T3	220	
tS2	BUSAK* setup prior to TH	140	

All times given in nanoseconds

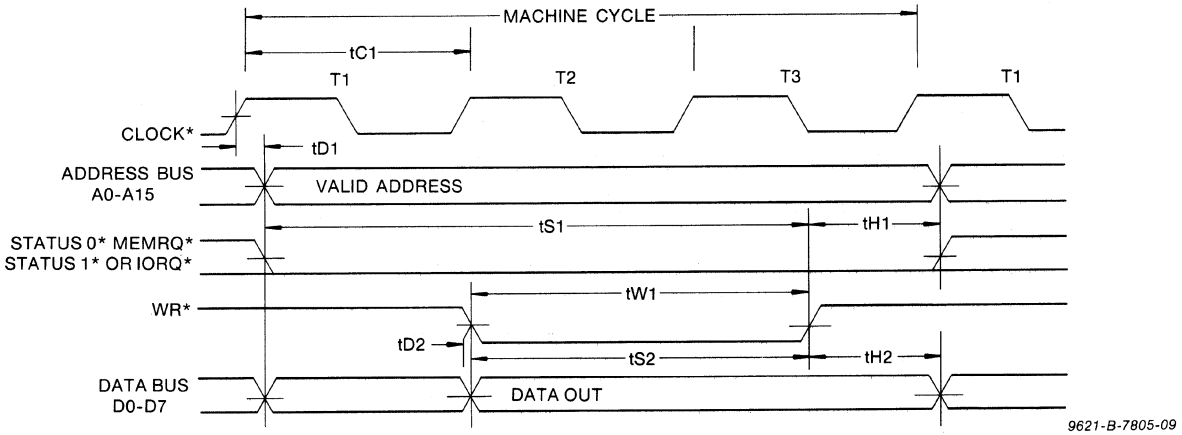
Figure 2-10. Bus Request Timing (78C05)



SYMBOL	PARAMETER	4.00 MHz	
		MIN	MAX
tC1	Clock cycle time		500
tH1	WAITRQ* hold time after T2/TW	0	
tS1	Address setup before WAITRQ*		450
tS2	WAITRQ* setup before T2/TW	155	

All times given in nanoseconds

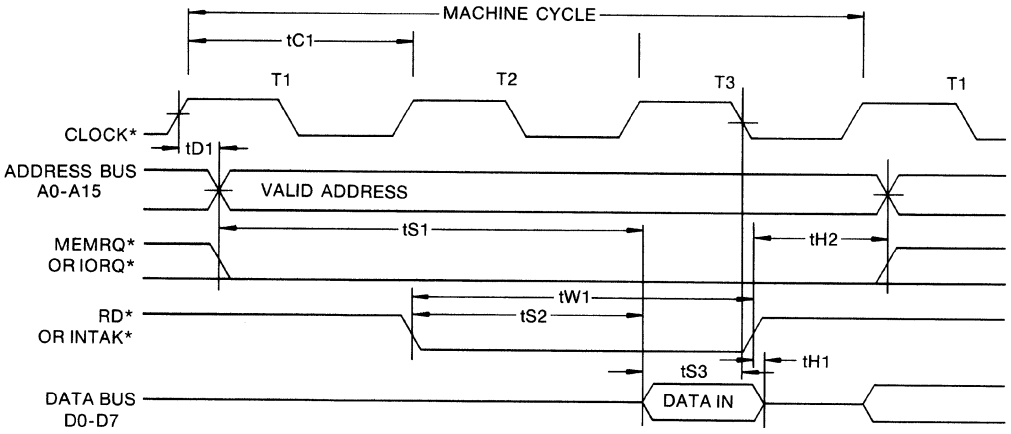
Figure 2-11. Wait Request Timing (78C05)



SYMBOL	PARAMETER	4.00 MHz	
		MIN	MAX
tC1	Clock cycle time		500
tD1	Address delay from T1 clock		265
tD2	Data delay from WR*		140
tH1	Address hold time	110	
tH2	Data hold time	85	
tS1	Address setup before write strobe	950	
tS2	Data setup time before write strobe	590	
tW1	WR* pulse width	570	

All times given in nanoseconds

Figure 2-12. Write Timing: Memory Write and Output (78C05)



SYMBOL	PARAMETER	4.00 MHz	
		MIN	MAX
tC1	Clock cycle time		500
tD1	Address delay from T1 clock		265
tH1	Data hold time	0	
tH2	Hold time after RD*	110	
tS1	Address setup before data valid		950
tS2	RD* setup before data valid		520
tS3	Data setup time	265	
tW1	RD* pulse width	570	

All times given in nanoseconds

Figure 2-13. Read Timing: Memory Read, Input, and Interrupt (78C05)

SPECIFICATIONS

Figure 2-14 shows the electrical specifications for the 78C05. Environmental and power specifications are shown in figures 2-15 and 2-16. Figure 2-17 gives the pinout and loading characteristics of the connection between the 78C05 and the STD BUS.

			Recommended Operating Limits			Absolute Non-Operating Limits	
MNEM	PARAMETER	UNIT	MIN	TYP	MAX	MIN	MAX
VCC	Logic supply	V	4.50	5.00	5.50	0	7.00

Figure 2-14. Electrical Specifications (78C05)

			Recommended Operating Limits			Absolute Non-Operating Limits	
MNEM	PARAMETER	UNIT	MIN	TYP	MAX	MIN	MAX
—	Free air temp	°C	-40	+25	+85	-40	+100
—	Humidity	% RH	5	—	95[1]	5	95[1]

[1]Noncondensing relative humidity

Figure 2-15. Environmental Specifications (78C05)

			Recommended Operating Limits		
MNEM	PARAMETER	UNIT	MIN	TYP	MAX
ICC	VCC supply current	mA		60	90

Figure 2-16. Electrical Characteristics Over Operating Range (78C05)

BUS INTERFACE

The 78C05 is a CMOS card designed to work with other CMOS cards on the STD BUS. It interfaces to other cards using CMOS logic levels and drive characteristics. While it can be interfaced to cards using TTL logic, proper CMOS to TTL interface procedures should be observed.

POWER-ON AND PUSHBUTTON RESET

Power-on reset holds the SYSRESET* line low and releases it a maximum of 85 ms after the VCC reaches 4.5V. The PBRESET* is debounced approximately 20 ms, and produces a maximum 65 ms SYSRESET* pulse.

PIN NUMBER	OUTPUT (CMOS DRIVE)[1]	INPUT (CMOS LOADS)[1]	MNEMONIC		PIN NUMBER	OUTPUT (CMOS DRIVE)[1]	INPUT (CMOS LOADS)[1]	MNEMONIC
2		IN	+5V		1		IN	+5V
4		IN	GROUND		3		IN	GROUND
6			-5V		5			-5V
8	20	1	D7		7	20	1	D3
10	20	1	D6		9	20	1	D2
12	20	1	D5		11	20	1	D1
14	20	1	D4		13	20	1	D0
16	20	1	A15		15	20	1	A7
18	20	1	A14		17	20	1	A6
20	20	1	A13		19	20	1	A5
22	20	1	A12		21	20	1	A4
24	20	1	A11		23	20	1	A3
26	20	1	A10		25	20	1	A2
28	20	1	A9		27	20	1	A1
30	20	1	A8		29	20	1	A0
32	20	1	RD*		31	20	1	WR*
34	20	1	MEMRQ*		33	20	1	IORQ*
36	OUT	2	MEMEX (GROUND)		35	OUT		IOEXP* (GROUND)
38	20	1	MCSYNC* (ALE*)		37			REFRESH*
40	20	1	STATUS 0* (SO)*		39	20	1	STATUS 1* (S1*)
42		1	BUSRQ* (HOLD*)		41	20	1	BUSAK (HLDA)*
44		1	INTRQ* (INTR*)		43	20	1	INTAK* (INTA*)
46		1	NMIRQ* (TRAP*)		45		1	WAITRQ* (READY)
48		[2]	PBRESET* (R*)		47	20	1	SYSRESET* (RST*)
50			CNTRL* (EXT CLK IN)		49	20		CLOCK*
52		IN	PCI		51	OUT		PCO
54			AUX GND		53			AUX GND
56			AUX -V		55			AUX +V

[1] CMOS load = 10 pF at ±5 μA
[2] Switch Input
* Designates active low-level logic
( ) Designates equivalent 80C85A pin names

Figure 2-17. STD BUS Edge Connector Pin List (78C05)

SECTION 3
Operation and Programming

Section 3 normally contains instructions for operating and programming of Pro-Log Series 7000 STD BUS cards. The 78C05 requires no special operating instructions.

SECTION 4
Operating Software

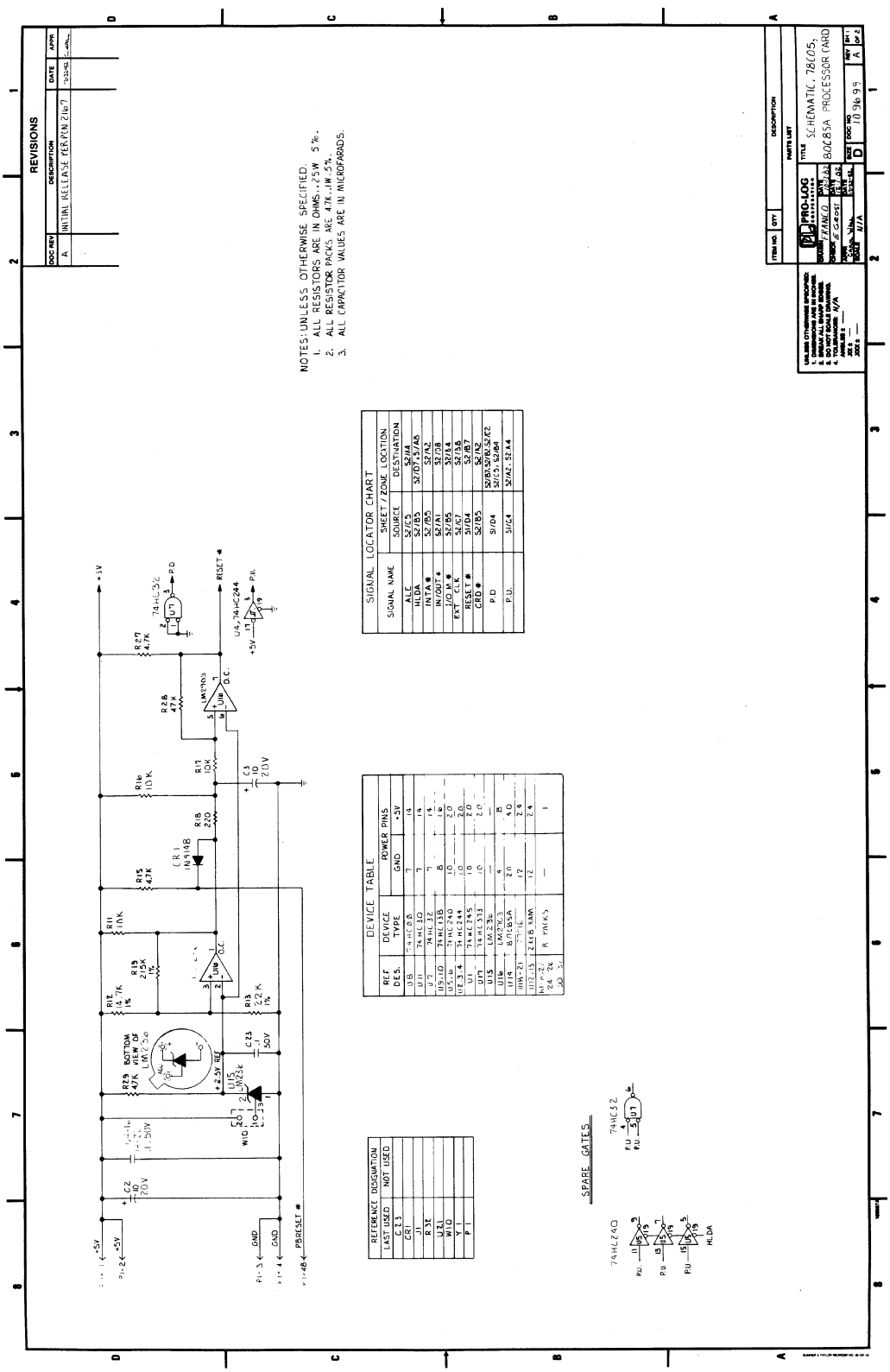
Section 4 normally contains software subroutines to aid in using Pro-Log Series 7000 STD BUS cards. The 78C05 requires no special operating software.

SECTION 5
Maintenance

REFERENCE DRAWINGS

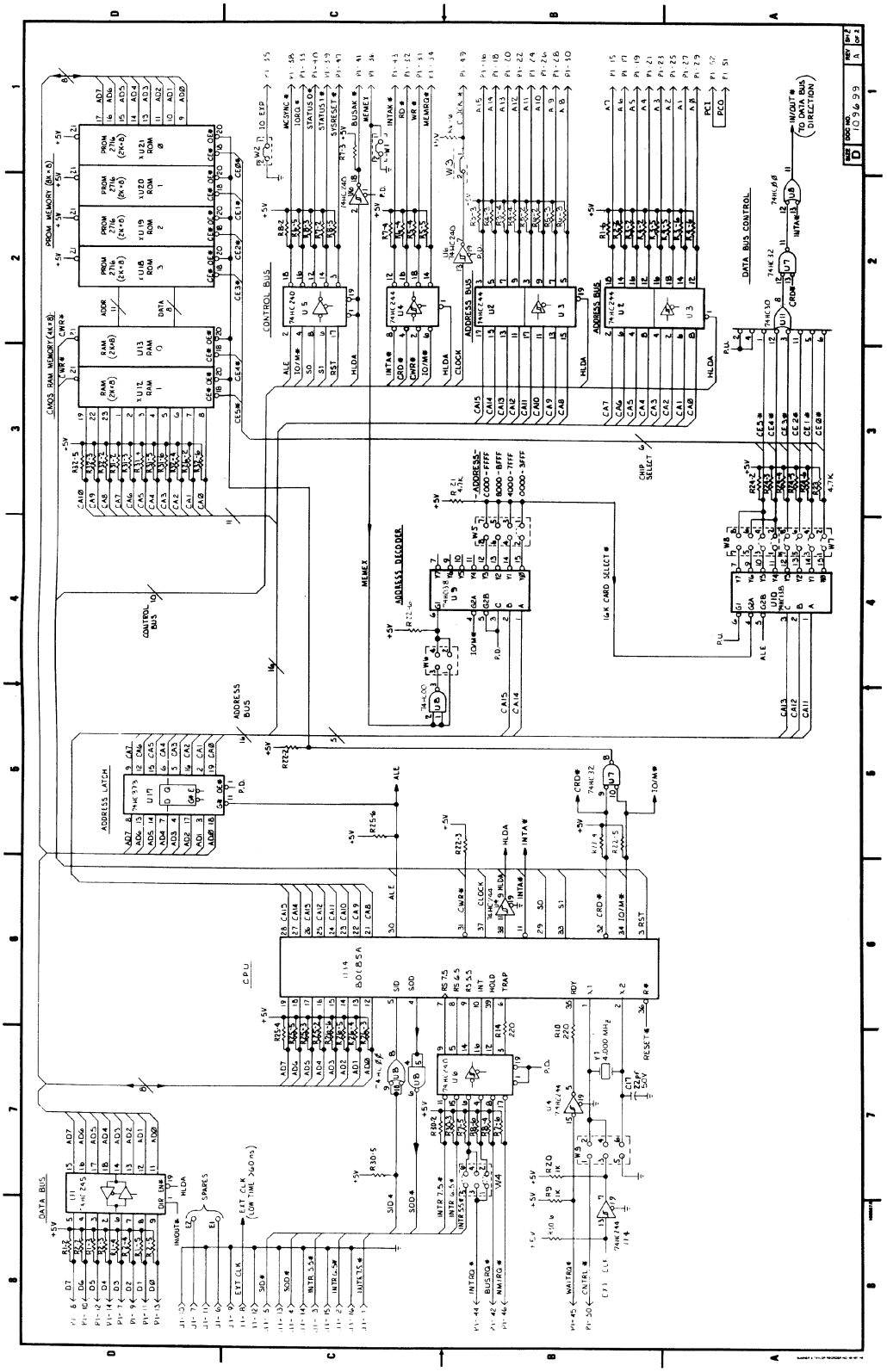
The schematic (figures 5-1 and 5-2) and assembly drawing (figure 5-3) in the following pages are included in this manual FOR QUICK REFERENCE USE ONLY. They may differ in some respects from the card and documentation that the user receives from Pro-Log.

The schematic and the assembly drawing shipped by Pro-Log with the card are those from which the card was manufactured.



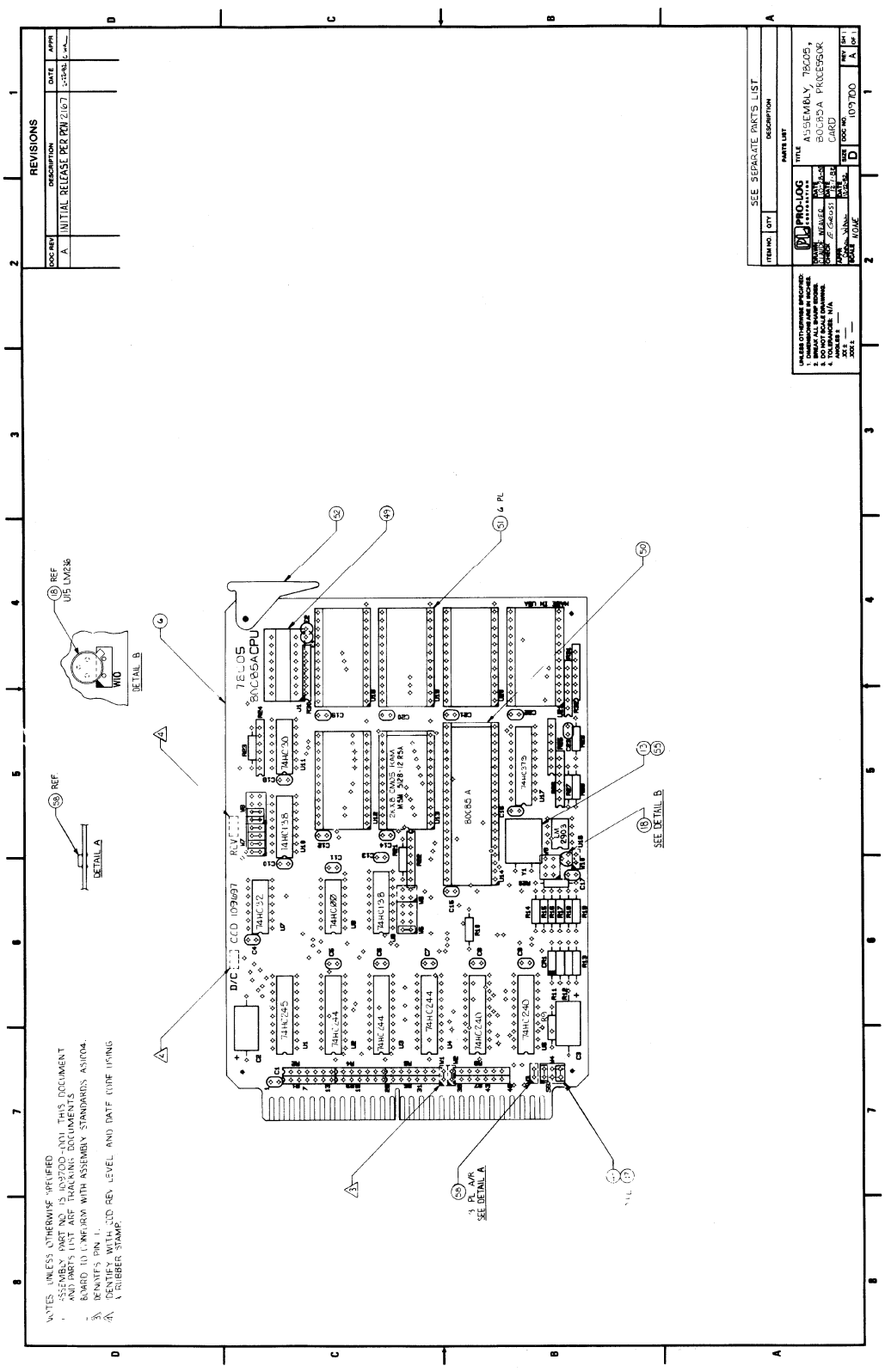
(Reference only. Refer to the documents shipped with the card.)

Figure 5-1. Schematic Page 1 (78C05)



(Reference only. Refer to the documents shipped with the card.)

Figure 5-2. Schematic Page 2 (78C05)



(Reference only. Refer to the documents shipped with the card.)

Figure 5-3. Assembly (78C05)

RETURN FOR REPAIR PROCEDURES

Domestic Customers:

1. Call Customer Support at (800) 538-9570, ext. 3617. In California call (408) 646-3617.
2. Explain the problem and we may be able to solve it on the phone. If not, we will give you a Customer Return Order (CRO) number.

   Mark the CRO number on the shipping label, packing slip, and other paperwork accompanying the return. Pro-Log cannot accept returns without a CRO.
3. Please be sure to enclose a packing slip with CRO number, serial number of the equipment (if applicable) reason for return, and the name and telephone number of the person Pro-Log should contact (preferably the user), if there are further questions.
4. Package the equipment in a solid cardboard box secured with packing material.

CAUTION

Loose MOS integrated circuits, or any product containing CMOS integrated circuits, must be protected from electrostatic discharge during shipment. Use conductive foam pads or conductive plastic bags, and never place MOS or CMOS circuitry in contact with Styrofoam materials.

5. **Ship prepaid and insured to:**

   Pro-Log Corporation
   2411 Garden Road
   Monterey, California 93940

   Reference CRO #_____.

International Customers:

Equipment repair is handled by your local Pro-Log distributor. If you need to contact Pro-Log, the factory can be reached at any time by TWX at 910-360-7082.

Limited Warranty

Limited Warranty: Seller warrants that the articles furnished hereunder are free from defects in material and workmanship and perform to applicable, published Pro-Log specifications for two years from date of shipment. This warranty is in lieu of any other warranty expressed or implied. In no event will Seller be liable for special or consequential damages as a result of any alleged breach of this warranty provision. The liability of Seller hereunder shall be limited to replacing or repairing, at its option, any defective units which are returned f.o.b. Seller's plant. Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by warranty. Seller shall have the right of final determination as to the existence and cause of defect. As to items repaired or replaced, the warranty shall continue in effect for the remainder of the warranty period, or for ninety (90) days following date of shipment by Seller or the repaired or replaced part whichever period is longer. No liability is assumed for expendable items such as lamps and fuses. No warranty is made with respect to custom equipment or products produced to Buyer's specifications except as specifically stated in writing by Seller and contained in the contract.

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- ☐ I am currently using Pro-Log equipment.
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